LUMINOUS BINARY SUPERSOFT X-RAY SOURCES

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Fourth Year Report on Luminous Binary Supersoft X-Ray Sources

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1 Summary

One of the key accomplishments of the two preceding years was our development of an algorithm to select SSSs in external galaxies which have been observed by *Chandra* or *XMM-Newton*. By applying this algorithm to data from a number of galaxies, we discovered an extension of the class of SSSs to sources that are somewhat harder ($100 - 300$ eV, instead of tens of eV), but which are nevertheless much softer than canonical X-ray sources. We call these new sources quasisoft sources (QSSs).

During this past year, we have built on and extended this work. We have (1) continued to identify SSSs and QSSs in external galaxies, (2) worked on models for the sources and find that black hole models seem promising for a subset of them, and (3) have studied individual systems, especially M101-ULX1. This special system has been observed as an SSS in its high state, with a luminosity in excess of 10^{41} erg s^{-1}. It has also been observed as a QSS when it is less luminous, and as a hard source in its low state. It is one of the best candidates to be an accreting intermediate-mass black hole.

We have several papers in preparation. Below we list papers which are complete, including only new work and papers whose status has changed (e.g., been accepted for publication) since our last report.

In addition, our work on QSSs has received some publicity. It was the subject of a *Chandra* press release and was picked up by several media outlets.

2 Publications

1. "Chandra ACIS and Newton EPIC Observations of the X-ray Luminous SN1978K in NGC 1313", Eric M. Schlegel, Albert Kong, Philip Kaaret, Rosanne DiStefano, Steve Murray, 2004 ApJ, 603, 644

2. "A Synoptic X-ray Study of M31 with the Chandra-HRC", Benjamin F. Williams, Michael R. Garcia, Albert K. H. Kong, Frank A. Primini, A. R. King, Stephen S. Murray, 2004, ApJ, 609, 735

3. "Supersoft X-Ray Sources in M31. I. A Chandra Survey and an Extension to Quasisoft Sources", R. Di Stefano, A.K.H. Kong, F.A. Primini, M.R. Garcia, P. Barmby, P. Massey, P.W. Hodge, B.F. Williams, S.S. Murrary, S. Curry, T.A. Russo, 2004, ApJ, 610, 247

4. Supersoft X-Ray Sources in M31. II. ROSAT-detected Supersoft Sources in the ROSAT, Chandra, and XMM-Newton Eras", Greiner, J.; Di Stefano, R.; Kong, A.; Primini, F., 2004, ApJ, 610, 261

5. "The Discovery of Quasisoft and Supersoft Sources in External Galaxies", R. Di Stefano, A.K.H. Kong, 2004, ApJ, 609, 710

6. "The Importance of Monitoring Soft X-Ray Sources", Rosanne Di Stefano, in the proceedings of the workshop: *X-Ray Timing 2003: Rossi and Beyond*, P. Kaaret and J. Swank editors, AIP Conference Proceedings, 714, 451

7. "The Ultraluminous X-Ray Source NGC 1313 X-2 (MS 0317.7-6647) and Its Environment", Zampieri, Luca; Mucciarelli, Paola; Falomo, Renato; Kaaret, Philip; Di Stefano, Rosanne; Turolla, Roberto; Chieregato, Matteo; Treves, Aldo, 2004, ApJ, 603, 523.

8. "Evidence of an Intermediate-Mass Black Hole: Chandra and XMM-Newton Observations of the Ultraluminous Supersoft X-Ray Source in M101 during Its 2004 Outburst", Kong, A. K. H.; Di Stefano, R.; Yuan, F. 2004, ApJL, 617, 49